

COSC 120: HW#3

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1. **Palindrome Testing:** A palindrome is a word, phrase, number, or other sequence of characters which reads the same backward or forward, such as *radar* or *kayak*. Sentence-length palindromes may be written when allowances are made for adjustments to capital letters, punctuation, and word dividers, such as “Was it a car or a cat I saw?” or “No ‘x’ in Nixon”. Write a program that can tell if a word or sentence is a palindrome.
2. **Text Based Adventure game:** Expand the adventure game that you began in class to a minimum of 6 rooms with multiple outcomes per a room. Feel free to use anything we have covered up to this point in the course. This is an opportunity to fully showcase your creativity!
3. **Marble and Card Drawing:** If there are 200 marbles in a jar and 40 different types. What is the probability that you can choose 2 of the same type of marble in sequence without replacement? Can you create a simulation of this experiment in python? Can you do the same simulation for 2 card types chosen from a 52 card deck?
4. **Goldbach’s Conjecture:** Goldbach’s conjecture is one of the oldest and most well known unsolved problems in number theory and possibly all of mathematics. It simply states that:
Every even integer greater than 2 can be expressed as the sum of two primes.
The conjecture has been shown to hold up through 4E18 (python for 4×10^{18}) but a successful proof has never materialized despite tremendous efforts.
 - (a) Write python code that can verify that Goldbach’s conjecture holds for all positive even numbers up to 100. Make sure your code clearly displays the prime sum, e.g. $12 = 7 + 5$.
 - (b) Generalize your code so that a user enters an even number between 2 and 500 and your code outputs the sum of two primes that add up to that number.
5. **A Falling Object:** An object falling vertically through the air is subjected to viscous resistance as well as to the force of gravity. Assume that an object with mass m is dropped from a height y_0 and that the height of the object after t seconds is:

$$y(t) = y_0 - \frac{mg}{k}t + \frac{m^2g}{k^2}(1 - e^{-kt/m})$$

where $g = 32.17 \text{ ft/s}^2$ and k represents the coefficient of air resistance in lb-s/ft. Suppose $y_0 = 300$ ft, $m = 0.25$ lb, and $k = 0.1$ lb-s/ft. Find, to within 1E-4 (10^{-4} in python) second, the time it takes for this quarter-pounder McDonald’s cheeseburger to hit the ground using your bisection method from class. How many iterations did it take? What was the interval you used for time?